

Does Aeration of Pastures and Hayfields Pay?

The Georgia Cattleman

February 2000

A common question often asked by cattlemen is, "Does soil aeration pay?" This is a good question as soil aerator machines require a substantial expenditure and many claims are being made about substantial yield increases after aeration of pastures or hayfields. Aerator machines are tractor-drawn with varying designs such as coulters making a narrow slit in the soil, a roller with many spikes making indentations in the soil, or prongs which function like a mini-subsoiler.

Purpose of aeration

The main problem that might justify aeration is soil compaction, caused by cattle hooves or farm equipment driven over the field. This type of compaction is primarily at the soil surface, affecting the top two or three inches. Compaction in this area would be expected to reduce water infiltration and increase runoff, thus decreasing forage yield. Alleviation of this type of compaction by breaking up the compacted crust on the surface should allow more water infiltration and improve forage growth. Aeration with these machines would not benefit soils having a compacted plow pan or natural hardpan at greater depths and would require subsoiling equipment for deep tillage. Experiments in Alabama have shown that bahiagrass roots are very effective in penetrating these pans and allowing roots of succeeding crop plants in a rotation to obtain water at greater depths and greatly improve yields for over four years.

The second problem that aeration equipment might be used for is thatch buildup. This is simply an accumulation of leaves and stems which are not decomposed and form a dense layer at the soil surface. Again, a heavy thatch buildup can reduce water infiltration and thus result in less water available for plant growth. It should be pointed out that water storage capacity of compacted soil is less than in friable non-compacted soil, particularly if it contains substantial organic matter.

How does one determine if aeration pays?

This may seem easy to answer but there are problems in getting results one can trust. If the hay yield after aeration of a field was higher than in the preceding year, then one might conclude that this practice paid off. However, the rainfall probably was not the same in both years. Likewise, comparing aeration of fields on two separate farms in the same year may be misleading as other farm practices may differ. Even comparing two fields on the same farm in the same year may not be dependable as the soil or slope on the two fields may differ.

The only reliable way to determine forage yield benefits from aeration is to measure the yield of forage from a number of aerated and non-aerated strips in a field as would be done by researchers. Small strips can be harvested in hayfields or caged areas can be harvested in pastures and averaged separately from the aerated and non-aerated areas.

Research results on aeration

A few replicated field experiments have been conducted with aerators or chisels on pastures or hayfields. Coastal bermudagrass on an eroded soil with a clay pan on the surface was chiseled to a depth of six inches in the Texas Blacklands which doubled or tripled forage yields. In Wales, a

perennial ryegrass pasture on clay loam soil grazed with cattle for 26 years was aerated with rotating long triangles that penetrated to a depth of 5 inches, doubling forage yield.

In contrast to these two success stories, other experiments have been less encouraging. In eastern Oklahoma, treatment of a bermudagrass pasture with a spike-toothed aerator had little effect on yield. A large 2-year study on aeration was done on silty soil at the Brown loam Station and on sandy loam soil at the South Mississippi Station in Mississippi where an aerator, shank renovator, disk, and deep chisel were compared to controls on bahiagrass pasture and bermudagrass hay fields at both locations. Treatments were also tested at different times of the year. The aerator penetrated to a depth of 2 inches on silty soil and nearly 3 inches on the sandy loam. None of the treatments had any effect on soil penetration resistance, moisture content, or forage yield.

Experiments at the Middle Tennessee and University of Tennessee-Knoxville experiment stations on tall fescue showed virtually no difference in forage yield between aerated and non-aerated areas. Demonstrations with aerated and non-aerated strips of tall fescue on four farms in south central Tennessee by a county agent showed a forage yield advantage of only 214 pounds of dry forage per acre. The cost of aeration was estimated at approximately \$10 per acre. It was concluded that aeration did not pay the expenses. In a study at the Sand Mountain Substation in north Alabama, two types of soil aerators increased tall fescue yields but the cost of aeration exceeded the value of extra forage produced.

Conclusions on aerators

Most of the research done on the value of aerators for pasture and hay is not encouraging. This does not mean that aeration will always be ineffective. It is possible that there are sites where severe compaction problems exist from cattle trampling or heavy equipment traffic on certain soils where aerator equipment may improve water infiltration and increase forage yields. Careful evaluation of potential aeration sites should be done before using a soil aerator. From research results so far, it is unlikely that most areas will give much economic benefit from this practice. Soil disturbance by an aerator can also be expected to increase weed problems in a pasture. The reason for this is that soil disturbance will scarify hard coats of weed seed lying in the soil so they germinate.